

Claims

1. An apparatus for heat exchange, in particular for
5 use in motor vehicles and especially for use in motor
vehicle air conditioning systems which as refrigerant
include a fluid with carbon dioxide (CO₂) as at least
one constituent, having
- 10 at least one feed line and discharge line, which open
out into a distribution or collection space,
respectively, for a fluid, and
- at least one through-flow device, having
- 15 at least one first end-side flow connection
section, through which the fluid enters the
through-flow device or leaves the through-flow
device,
- 20 at least one second end-side flow connection
section, through which the fluid leaves the
through-flow device or enters the through-flow
device, and
- 25 the first flow connection section is flow-
connected to the second flow connection section by
at least one tube section,
- 30 characterized in that
- at least one of the flow connection sections is twisted
at least once,
- 35 the first or second flow connection section is flow-
connected to the collection space,
- the second or first flow connection section is flow-
connected to the distribution space.

2. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in claim 1, characterized in that the tube section has at least one
5 straight section.

3. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in one of the preceding claims, characterized in that the tube
10 section has at least one curved section.

4. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the tube
15 section has at least one twisted section.

5. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in one of the preceding claims, characterized in that the tube
20 section has at least two curved sections with different radii of curvature.

6. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in one of the preceding claims, characterized in that the number of
25 first and/or second flow connection sections is equal to the number of tube sections.

7. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in one of the preceding claims, characterized in that the through-flow device has at least one flow passage, preferably a plurality of flow passages for passing on the refrigerant, and preferably has a cross section in the
30 form of a flat tube.

8. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in one of the preceding claims, characterized in that the through-

flow device is made at least from a material selected from a group of materials consisting of metals, in particular aluminum, manganese, silicon, magnesium, iron, brass, copper, tin, zinc, titanium, chromium, molybdenum, vanadium, silicon, magnesium and alloys such as EN-AW 3003, EN-AW 3102, EN-AW 6060, EN-AW 1110 thereof, plastics, fiber-reinforced plastics, composite materials.

9. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that at least the first and/or second flow connection section is twisted over a predetermined angle.

10. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the magnitude of the twisting angle is between 10° and 180° , preferably between 45° and 135° , and particularly preferably between 80° and 100° .

11. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the two transition sections are twisted in the same twisting direction.

12. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the two transition sections are twisted in opposite twisting directions.

13. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the tube section is multiply twisted.

14. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the tube section is twisted at least twice in the same twisting
5 direction.

15. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the tube
10 section is twisted at least twice in different twisting directions.

16. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one
15 of the preceding claims, characterized in that the twisting angles of at least two twists of the tube section are substantially equal or equal in opposite directions.

17. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the curved section and/or the twisted section of the tube
20 section is connected to a supporting element.

18. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that a plurality of distribution/collection spaces which are
25 thermally separated from one another are provided.

19. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the
35 thermal separation is effected by a plurality of distribution/collection spaces being spaced apart from one another.

20. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the thermal separation is effected by providing a material
5 which promotes thermal separation between the distribution/collection spaces.

21. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one
10 of the preceding claims, characterized in that the distribution/collection space has receiving devices, the internal cross section of the receiving devices substantially corresponding to the external cross section of the through-flow device.

15 22. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the receiving devices are substantially rectangular in
20 form, and the longer side of these receiving devices is arranged at a predetermined angle with respect to the longitudinal direction of the distribution/collection device.

25 23. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the magnitude of the angle is between 0° and 90° , preferably between 0° and 45° , and particularly
30 preferably between 0° and 10° .

24. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that a
35 plurality of through-flow devices are arranged substantially parallel to one another.

25. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one

of the preceding claims, characterized in that cooling fins are provided between the through-flow devices.

26. An apparatus for heat exchange, in particular the
5 apparatus for heat exchange as claimed in at least one
of the preceding claims, characterized in that the tube
sections of the through-flow devices and the supporting
element are at least partially connected to one another
positively, cohesively and/or non-positively.

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27. An apparatus for heat exchange, in particular the
apparatus for heat exchange as claimed in at least one
of the preceding claims, characterized in that frame
devices are provided and are at least partially
15 connected positively, non-positively and/or cohesively
to the supporting element and/or the
collection/distribution space.

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28. An apparatus for heat exchange, in particular the
apparatus for heat exchange as claimed in at least one
of the preceding claims, characterized in that there is
at least one separating device dividing the collection
space and/or the distribution space into at least two
space sections in a gastight and liquid-tight manner.

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29. An apparatus for heat exchange, in particular the
apparatus for heat exchange as claimed in at least one
of the preceding claims,

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characterized in that

two distribution and/or collection spaces are provided

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at least one separating device is provided, dividing at
least one of the two distribution and/or collection
spaces into at least two space sections in a gastight
and liquid-tight manner, and

the two distribution and/or collection spaces are in flow connection only via the at least one through-flow device.

5 30. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the feed line and discharge line are provided at one of the two collection and/or distribution spaces, preferably at
10 the distribution and/or collection space which has the separating device.

31. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one
15 of the preceding claims, characterized in that the feed line and the discharge line extend substantially in the longitudinal direction of the distribution or collection space at which they are arranged.

20 32. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that the separating device divides the distribution or collection space in such a way that the ratio of the
25 length of the section facing the feed line to the length of the section facing the discharge line is between 9:1 and 1:5, preferably between 5:1 and 1:1, and particularly preferably is approximately 2:1.

30 33. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that at least one space section of the distribution space is flow-connected to at least one space section of the
35 collection space by at least one connection device.

34. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that at least

one space section of a first distribution/collection space is flow-connected to a further space section of a second distribution/collection space by at least one connecting device, the first distribution/collection
5 space and the second distribution/collection space not lying on a straight line.

35. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one
10 of the preceding claims, characterized in that the connection device is provided in the region of the separating device and is preferably formed integrally with the separating device.

15 36. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that a plurality of separating/connection devices, which are preferably in single-part form, are provided and effect
20 multiple diversions of the refrigerant.

37. An apparatus for heat exchange, in particular the apparatus for heat exchange as claimed in at least one of the preceding claims, characterized in that a
25 distribution space, a collection space, a through-flow device and a feed and discharge line are components which form a module.

38. A device for exchanging air, in particular for
30 motor vehicle air-conditioning systems, having air flow paths, air flow control elements, at least one air delivery device and a housing which is suitable for receiving at least one apparatus for heat exchange, in particular as claimed in at least one of the preceding
35 claims, or within which an apparatus for heat exchange of this type is arranged.

39. A device for exchanging heat, in particular for motor vehicle air-conditioning systems, having at least

one condenser, a compressor, an expansion valve, a collector and at least one apparatus for heat exchange, in particular as claimed in at least one of the preceding claims.

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40. A process for producing a through-flow device, in particular a flat tube for an apparatus for heat exchange, which includes the following steps:

- 10 - production of a through-flow device extending substantially in one longitudinal direction;
 - twisting of at least one first end-side flow connection section and at least one second end-side flow connection section through a
15 predetermined twisting angle.

41. A process for producing a through-flow device as claimed in claim 30, characterized in that

- 20 - the through-flow device is curved in the region around a predetermined bending angle with respect to the longitudinal direction of the through-flow device to produce a curved section.

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42. A process for producing a through-flow device, in particular as claimed in at least one of claims 30 or 31, characterized in that the bending angle amounts to 0°, 30°, 45°, 60°, 90°, 120° or 180° or any desired
30 values in between.

43. A process for producing a through-flow device, in particular as claimed in at least one of claims 30, 31 or 32, characterized in that the through-flow device is
35 twisted at least in one region, the twisting angle amounting to 0°, 30°, 45°, 60°, 90°, 120° or 180° or any desired values in between.